

REMARKS

Acceptance of this Amendment which has been filed as a Submission in accordance with the U.S. PTO RCE procedure, as well as withdrawal of the finality of the last Office Action, are respectfully requested. Reconsideration and allowance of the above-identified application, as currently amended, is also respectfully requested.

By the present Submission, claims 4-14 and 21-24 are pending of which claims 4, 7-8, 11, 14, 22 and 23 were amended. The current revisions are intended to clarify various structurally characterizing aspects of the invention, including in terms of more particularly highlighting the relative positioning of the driving means of the operating fluid (the operating fluid being hermetically enclosed within the enclosable passage), as well as that pertaining to the heat transfer layer of the set forth semiconductor integrated circuit chip. It is submitted, independent claims 4, 14, 22 and 23 and further according to the dependent claims thereof, are defining over the combined teachings of the references, as applied in the outstanding rejections.

It is submitted, also, the amendments made to the claims render them in full compliance with the applicable requirements under 35 U.S.C. §112 and, therefore, rendering moot the outstanding rejection under 35 U.S.C. §112, second paragraph, i.e., on alleged indefiniteness grounds, in item 5 in the Detailed Action of the Final Office Action. That is, each of the independent claims 4, 14, 22 and 23 was redrafted so as to be in full compliance of the statute requirements directed thereto and also consistent with the example embodiments disclosed in the original specification. This should become apparent from a careful reading of the revised

claims including in conjunction with the related example disclosed embodiments such as illustrated in connection with Figs. 1 and 4-7 of the drawings, although not to be construed as being limited thereto (see also attached Sketch A).

According to independent claim 4, the invention is:

A semiconductor integrated circuit chip, formed as a plate-like semiconductor chip having a first principal surface side and an oppositely facing second principal surface side, comprising:

a circuit forming layer, on which a plurality of circuits are formed, being formed at a first main surface of an integrated circuit (IC) board, said first main surface corresponding to the first principal surface side of the plate-like semiconductor chip;

driving means of an operating fluid being formed at a second main surface of said IC board, opposite that of said first main surface; and

a heat transfer layer being made of a material similar to that of said IC board and connected with the IC board in one body, said heat transfer layer having an outer surface and an apposing inner surface, the outer surface thereof corresponding to the second principal surface side of the plate-like semiconductor chip and in which there is formed between an inner surface thereof and said second main surface of the IC board a closed flow passage, an operating fluid being hermetically enclosed within the closed flow passage,

wherein said driving means of the operating fluid is made of a resistor layer and is outside the close flow passage of said operating fluid, the resistor layer being electrically operated to give vibration to the hermetically enclosed operating fluid.

Independent claim 22 is similar to claim 4 although it does not specify that the driving means is made of a resistor layer.

With regard to independent claim 14, the first subparagraph of the claim is presented somewhat differently from that of claim 4, although both are consistent with the originally disclosed example embodiments of Figs. 1 and 4-7 (see attached Sketch A which is based on the showings in Fig. 1). Claim 23 is similar to claim 14, although it does not specify for the driving means to be made of a resistor layer.

Using the example illustration in attached Sketch A, and consistent with the showings in Fig. 1 and, correspondingly, according to Figs. 4+, the circuit forming layer (2) is formed at a first main surface of an IC board (1), the first main surface corresponding to the first principal surface side of the plate-like semiconductor chip (101) (see also 101 in Fig. 2). The semiconductor integrated circuit chip according to each of the independent claims is formed as a plate-like semiconductor chip having a first principal surface side and an oppositely facing second principal circuit side, such as shown in Sketch A, which is consistent with the originally disclosed example embodiments. The heat transfer layer of the invention is made of a similar material to that of the IC board, the IC board and heat transfer layer being constituted as a single body, in which the outer surface of the heat transfer layer (15) corresponds to the second principal surface side of the plate-like semiconductor chip. Between an inner surface of the heat transfer layer (15) and the second main surface of the IC board is formed a closed flow passage (3), in which an operating fluid (4) is hermetically enclosed within the closed flow passage. According to each of the independent claims 4, 14, 22 and 23, the invention further calls for:

driving means of an operating fluid being formed at a second main surface of said IC board, opposite that of said first main surface thereof.

According to independent claims 4 and 14, further, the driving means of the operating fluid is made of a resistor layer, the resistor layer being electrically operated to give vibration to the hermetically enclosed operating fluid (e.g., see electrically operated resistor layer 12 in Fig. 1 and also 5 in Figs. 4+). In all of the independent claims the invention calls for the driving means of the operating fluid to be formed on an IC board, consistent with Fig. 1 and Sketch A, for example.

Moreover, according to the present invention, the heat transfer layer is not only made of a material like that of the IC board (i.e., IC chip or IC substrate), but that the heat transfer layer is in direct connection with the opposing side of the IC board. In this regard, also, claims 14 and 23 call for the heat transfer layer (15) to be integrated with the IC board in one body (see page 14, lines 4-8, of the Substitute Specification). This is clearly seen in Sketch A which shows that the first main surface of the IC board relates to the first principal surface side of the plate-like semiconductor chip and that the second main surface of the IC board is the inner side surface of the IC board, which is internal to the plate-like semiconductor chip (101), noting that the claim calls for the heat transfer layer to be connected with the IC board in one body. The closed flow passage(s) (3) according to the claims is illustrated in Fig. 1 and further according to Figs. 4-7 of the drawings, although not to be construed as being limited thereto. It is submitted, the invention as now called for in each of the independent claims 4, 14, 22 and 23, and further according to the details of the dependent claims thereof, was neither disclosed nor could have been achievable in the manner as that alleged in the outstanding Final Office Action art rejections.

According to the outstanding Office Action, claims 4-9, 11, 12, 14 and 21-24 "as far as understood" stand rejected under 35 U.S.C. §103(a), allegedly, as being obvious over Zuo (USP 6,631,077) in view of *Microchip Fabrication* by Peter Van Zant and Ohashi et al (JP 07-286788); and claims 10 and 13 stand rejected under 35 U.S.C. §103(a), allegedly, over the same combination of Zuo in view of *Microchip Fabrication* by Peter Van Zant and Ohashi et al and further in view of

O'Connor et al (US 2002/0039280 A1). Insofar as presently applicable, these rejections are traversed and withdrawal of the same are respectfully requested.

Zuo discloses PCB assemblies (e.g., 100 in Fig. 1; 700 in Fig. 7). With regard to Fig. 1 thereof, 160 represents the IC chip and 110 represents the heat spreader. According to Zuo's construction, the driving means which generates bubbles within the operating fluid (e.g., 130) is formed on a base plate 111 (belonging to the heat spreader 110), but not on the IC chip 160, unlike that according to the present invention. It is submitted Zuo neither disclosed nor even hinted at a construction in which the heat spreader, the driving means as well as the closed flow passage(s) would be directly formed on the opposing side of an IC board, such as at the second main surface of the IC board 1 in Sketch A, consistent with independent claims 4,14,22 and23. Also, it is observed that the driving means of the operating fluid is not only made of a resistor layer (claims 4+ and 14), and is outside of the closed flow passage of the operating fluid (claims 4+), it is also formed at the second main surface of the IC board (independent claims 4+,14,22 and 24+).

It is submitted, also, independent claims 4, 14, 22 and 23 as well as the corresponding dependent claims thereof are defining even over the combined teachings of Zuo and the other references, as applied in the Final Office Action rejections. In this regard, Van Zant simply discusses different types of circuit categories, such as logic circuits, memory circuits as well as discusses a microprocessor. O'Connor was applied for its alleged teaching of employing a temperature detection means, according to that set forth in claims 10 and 13.

Ohashi et al was applied in the rejection for its alleged teaching of modifying the semiconductor device of Zuo to include "the use of a driving means of operating fluid...made of electrically operating means...." Notwithstanding the teachings of these other, secondary and tertiary references, the above-noted deficiencies of Zuo still could not have been overcome, insofar as the present claimed subject matter is concerned. That is a skilled artisan would not have been led to modify Zuo's assembly in a way that would have achieved the present invention, based on the combined teachings of Zuo and the above-named references. It is submitted, therefore, the invention according to independent claims 4, 14, 22 and 23 could not have been rendered obvious as alleged in the rejections. Correspondingly, dependent claims 5-13, 21 and 24, it is submitted, are likewise defining over the combined teachings of these art documents, at least for the same and similar reasons as that above.

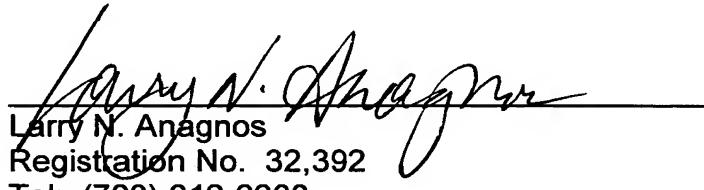
Therefore, in view of the above-made amendments together with the accompanying Remarks, withdrawal of the outstanding rejections, as well as favorable action on the pending claims 4-14 and 21-24 is respectfully requested.

If the Examiner deems that questions and/or issues still remain which would prevent the present application from being allowed at the present time, she is urgently invited to telephone the undersigned representative, at the number indicated below, so that either a telephone or personal interview may be arranged at the Examiner's convenience in order to discuss the same and hopefully resolve any remaining questions/issues present.

To the extent necessary, Applicants Petition for an Extension of Time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (Case No. 520.43306X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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Attachments

LNA:dlh

SKETCH A

